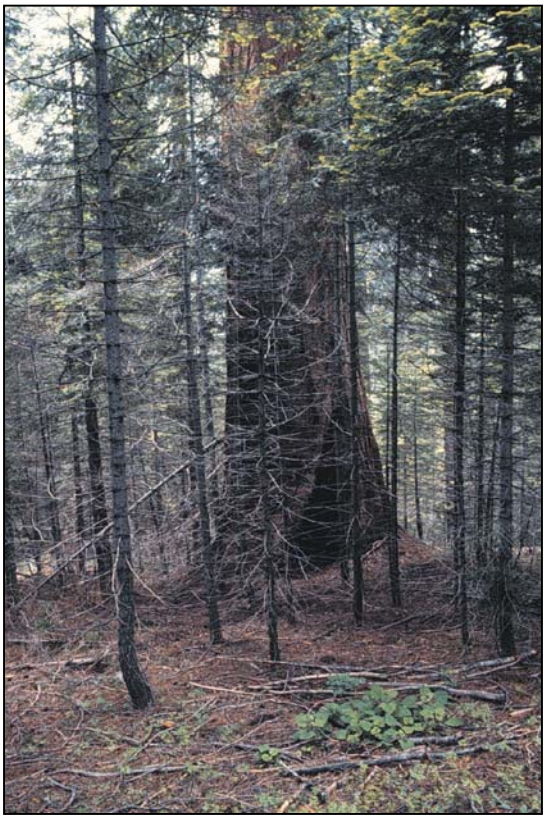
Vegetation – Sapling/Pole-size Trees



This document describes methods for monitoring changes in density and basal area of sapling/pole-size trees in forest or woodland areas. The sampling unit is a permanently marked plot of adjustable size and shape where individual trees are mapped and tagged. Attributes observed include tree species, diameter, and height class. These methods were developed for the National Park Service's (NPS) fire monitoring program but may be adapted for other monitoring purposes. For background information on the fire monitoring program, including the purpose and overview of the program, related policy, and personnel responsibilities, refer to Chapter 1, pages 1-5 of the NPS Fire Monitoring Handbook (FMH, http://www.nps.gov/fire/fmh/FEMHandbook.pdf). An overview of management objectives and the process for developing corresponding monitoring program objectives is reviewed in Chapter 3, pages 19-32 of the FMH.

Sampling design, including defining the population of interest, pilot sampling, calculating minimum sample size, and addressing potential design problems, is described in FMH Chapter 4, pages 33-54. Methods for generating and selecting plot locations and installing plots are found in FMH Chapter 5, pages 59-79. The schedule for monitoring prior to and following fire treatment is located in FMH Chapter 5, pages 55-58, although the schedule may be revised for other purposes. For a list of field equipment needs recommended for implementing this protocol, see FMH Appendix E, pages 221-224. Information about monitoring program file maintenance and data storage is found in FMH Chapter 5, pages 112-113. To review data quality procedures, see FMH Chapter 5, pages 114-117.

The field methods for the protocol described below are taken from FMH Chapter 5, pages 100-101 (http://www.nps.gov/fire/fmh/FEMHandbook.pdf). Specific forms developed for field data collection follow the protocol description.

Monitoring Pole-size Trees

Pole-size trees are defined in this monitoring system as standing living and dead trees with a diameter at breast height (DBH) ≥2.5 cm and ≤15 cm. You may modify this definition for your purposes; see page 44 for details.

Pole-size Tree Accuracy Standards

Accuracy standards for each variable discussed in this section are listed at the end of this section (Table 23, page 101).

MEASURE DENSITY AND DBH OF POLE-SIZE TREES

RS Procedures

Count and measure DBH for all pole-size trees within the sampling area chosen during the monitoring design process (see page 45). Check your protocols (FMH-4) before proceeding.

Tagging pole-size trees is optional. If you choose to tag pole-size trees, for each plot be sure to use numbers different from those used for overstory trees, e.g., 1-100 for poles and 500-600 for overstory. The procedure is as for overstory trees: drive an aluminum nail into **each** tree at BH so that the tag hangs down and away from the tree and several centimeters of nail remain exposed, leaving ample space for tree growth. Second, measure DBH (in centimeters) to the nearest mm, just above the nail. When the tree is too small to tag at BH, or the tagging nail could split the trunk, place the tag at the base of the tree.

On the Pole-size tree data sheet (FMH-9) record the quarter in which the tree occurs (Qtr), tag or map number, the species (Spp), the diameter (DBH) of each tree, and whether it is alive (Live).

For non-sprouting tree species forked below BH, individually tag and measure each pole-size bole. For sprouting tree species, tag and measure only the largest bole (in diameter) of the cluster. Remember that if the largest bole has a DBH of >15 cm, the tree is an overstory tree. Tally seedling-size sprouts as resprout class seedlings until they grow into the pole tree size class. **Note:** If the main bole of a sprouting species has died, but the tree is sprouting from the base, consider the main bole dead.

If the bole of a fallen tree is below BH, and the individual is resprouting, treat the sprouting branches as individuals and place them in the appropriate size class (seedling, pole, or overstory). Include clarifying comments on the data sheet, especially for resprouting trees.

For trees with swellings or voids at BH, refer to page 92 in the overstory tree section.

If you do not individually tag trees, you can assign a map number for each tree, or simply count them by species (and height class, if desired). Finally, map each tree using a map (or tag) number on the appropriate tree map (FMH-11, -12, -13, or -14).

OPTIONAL MONITORING PROCEDURES

Measuring Diameter at Root Crown for Woodland Species

Measurement of a tree's diameter at root crown (DRC) is an alternative to DBH measurement for tree species that are typically highly forked. This method is presented in the Overstory Tree section (page 97).

Measure Pole-size Tree Height

If you choose to measure this optional dataset, measure and record pole-size tree height (Hgt) on the Pole-size tree data sheet (FMH-9) for each tree encountered. Use height class codes five through 13 (Table 22, also available for reference on FMH-9).

Table 22. Height class codes for pole-size trees.
A tree must be breast height (1.37 cm) or taller to be classified as pole-size.

Code	Height (cm)	Code	Height (cm)	Code	Height (cm)	Code	Height (cm)
1	Æ Not Applicable for Pole-size Trees	5	100.1–200	9	500.1–600	13	900.1+
2		6	200.1–300	10	600.1–700		
3		7	300.1–400	11	700.1–800		
4		8	400.1–500	12	800.1–900		

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.

Table 23. Accuracy standards for pole-size tree (RS) variables.

Pole Tree	
DBH/DRC	± 0.5 cm
Pole Height	Within Class
Number of Individuals	± 5%

Park/Unit 4-Character Alpha Code: _____

FMH-9 **POLE-SIZE TREE DATA SHEET** Page ___ of ___

Plot ID: _____ B / C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20Other: ___-yr____; ____-mo___

Record: quarter (if other than Q1), tag # (Optional), species by code (Spp), DBH in centimeters, live/dead, and height by code (Hgt, Optional).

Qtr	Tag or Map#	Spp	DBH (cm)	Live	Hgt Code	Qtr	Tag or Map#	Spp	DBH (cm)	Live	Hgt Code
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
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				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	

Height Class Codes (height in centimeters):

1	↑ Not Applicable for Pole-size Trees ↓	**5**	100.1–200	**9**	500.1–600	**13**	900.1+
2		**6**	200.1–300	**10**	600.1–700		
3		**7**	300.1–400	**11**	700.1–800		
4		**8**	400.1–500	**12**	800.1–900		

Note: Measure height from ground level to the highest point of growth on the tree. The highest point on a bent tree would be down the trunk of the tree instead of at the growing apex.

Qtr	Tag or Map#	Spp	DBH (cm)	Live	Hgt Code	Qtr	Tag or Map#	Spp	DBH (cm)	Live	Hgt Code
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
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				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	
				Y N						Y N	

Park/Unit 4-Character Alpha Code: _____

FMH-4 **MONITORING TYPE DESCRIPTION SHEET**

Monitoring Type Code: _____ Date Described: __/__/__

Monitoring Type Name: _____

FGDC Association(s): _____

Preparer(s) (FEMO/RMS/FMO): _____

Burn Prescription (including other treatments: _____

Management Objective(s): _____

Monitoring Objective(s):_____

Objective Variable(s): _____

Physical Description: _____

Biological Description:_____

Rejection Criteria:_____

Notes:_____

Date Entered: ____/____/____

PLOT PROTOCOLS

GENERAL PROTOCOLS		(Circle One)			(Circle One)	
Preburn	Control Treatment Plots (Opt)	Y	N	Herb Height (Opt)	Y	N
	Herbaceous Density (Opt)	Y	N	Abbreviated Tags (Opt)	Y	N
	OP/Origin Buried (Opt)	Y	N	Herb. Fuel Load (Opt)	Y	N
	Voucher Specimens (Opt)	Y	N	Brush Fuel Load (Opt)	Y	N
	Count Dead Branches of Living Plants as Dead (Opt)				Y	N
	Width Sample Area Species Not Intercepted But Seen in Vicinity of Herbaceous Transect(s):					
	Length/Width Sample Area for Shrubs:			Stakes Installed:		
	Herbaceous Frame Dimensions:					
	Herbaceous Density Data Collected At:					
Burn	Duff Moisture (Opt)	Y	N	Flame Depth (Opt)	Y	N
Postburn	100 Pt. Burn Severity (Opt)	Y	N	Herb. Fuel Load (Opt)	Y	N
	Herbaceous/Shrub Data (Opt): FMH- 15/16/17/18					

FOREST PLOT PROTOCOLS		(Circle One)			(Circle One)	
Overstory (>15 cm)	Live Tree Damage (Opt)	Y	N	Live Crown Position (Opt)	Y	N
	Dead Tree Damage (Opt)	Y	N	Dead Crown Position (Opt)	Y	N
	Record DBH Year-1 (Opt)	Y	N			
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Pole-size (≥2.5≤15)	Height (Opt)	Y	N	Poles Tagged (Opt)	Y	N
	Record DBH Year-1 (Opt)	Y	N	Dead Pole Height (Opt)	Y	N
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Seedling (<2.5 cm)	Height (Opt)	Y	N	Seedlings Mapped (Opt)	Y	N
	Dead Seedlings (Opt)	Y	N	Dead Seedling Height (Opt)	Y	N
	Length/Width of Sample Area:			Quarters Sampled: Subset • Q1 • Q2 • Q3 • Q4		
Fuel Load	Sampling Plane Lengths:___ 1 hr • ___ 10 hr • ___ 100 hr • ___ 1,000 hr-s • ___ 1,000 hr-r					
Herbaceous	Cover Data Collected at: Q4–Q1 • Q3–Q2 • 0P–50P • Q4–30 m					
Postburn	Char Height (Opt)	Y	N	Poles in Assessment (Opt)	Y	N
	Collect Severity Along: Fuel Transects • Herbaceous Transects					

(Opt) = Optional

Park/Unit 4-Character Alpha Code: _____

FMH-5 **PLOT LOCATION DATA SHEET**

Plot ID: _____ B / C (Circle One) Date: ___/___/___

Burn Unit: _____ Recorder(s): _____

Topo Quad: _____ Transect Azimuth: ____ Declination: _____

UTM ZONE: _____	Lat: _____	Section: _____	Slope (%) along Transect Azimuth: _____
UTMN: _____	Long: _____	Township: _____	Slope (%) of Hillside: _____
UTME: _____		Range: _____	Aspect: _____ Elevation: _____

Location Information Determined by (Circle One): Map & Compass / GPS

If determined by GPS: Datum used: _____ (Circle One) PDOP/EHE: _____

Fire History of the Plot (including the date of the last known fire):_____

_____

1. Road and trail used to travel to the plot:_____

_____

_____

2. True compass bearing at point where road/trail is left to hike to plot: _____°

3. Describe the route to the plot; include or attach a hand-drawn map illustrating these directions, including the plot layout, plot reference stake and other significant features. In addition, attach a topo, orthophoto, and/or trail map.

4. Describe reference feature: _____

5. True compass bearing from plot reference feature to plot reference stake: _____°

6. Distance from reference feature to reference stake: _____m

7. Problems, comments, notes:_____

_____

_____

FMH-5A **HISTORY OF SITE VISITS**

Plot ID: ________________ B / C (Circle One) Burn Unit: __________________________

Date	Burn Status	Purpose	Comments

Date Entered: ____/____/____

Park/Unit 4-Character Alpha Code: _____

FMH-6 **SPECIES CODE LIST** Page ___ of ___

Use this form to record unknowns and official species codes. **Tip:** Place an asterisk next to each species you voucher.

Species Code	Life Form	Genus/Species (spell out full name)	Native (Circle One)	Annual/ Biennial/ Perennial
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
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			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	
			Y N	

Life Forms Codes:

A	Fern or Fern Ally	**G**	Grass	**R**	Grass-like	**T**	Tree	*****	Substrate
F	Forb	**N**	Non-vascular	**S**	Shrub	**U**	Subshrub	**V**	Vine

Date Entered: ___/___/___

VOUCHER SPECIMEN DATA COLLECTION FORMS

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Date: Plot ID: Collected by: Coll. #

Latin Name: Family:

Common Name:

Description: ann/bien/per Life form: ht.: Habitat:
flr. color: other:
fruit type:

Topo Quad: Assoc. spp.:

Location (UTM, lat/long): Elev.: Slope: Aspect:

Comments:

Park/Unit 4-Character Alpha Code: _____

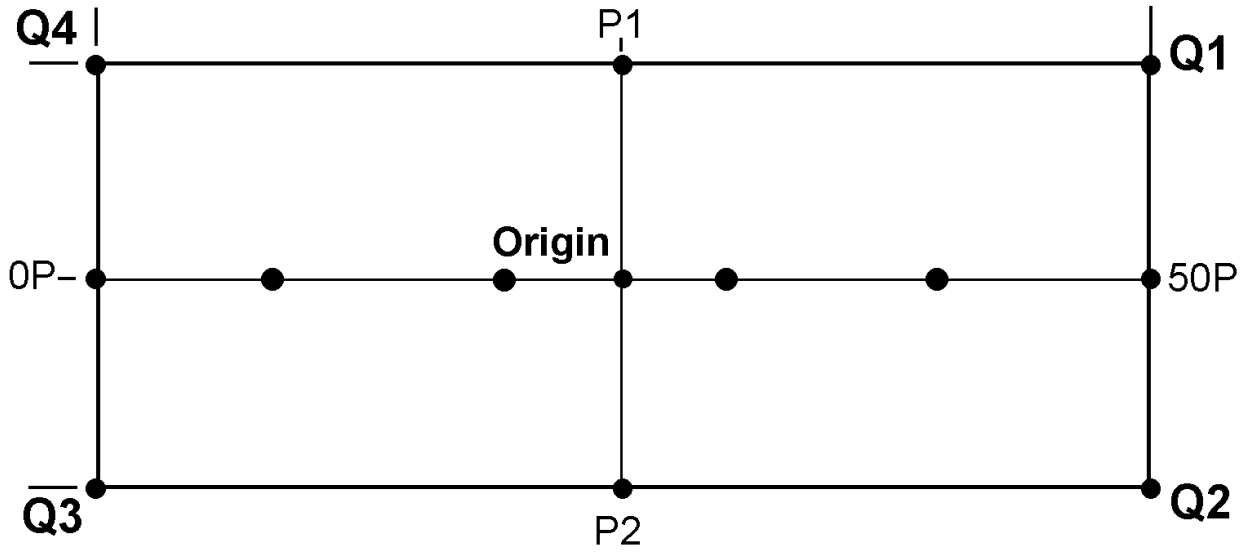
FMH-7 **FOREST PLOT DATA SHEET**

Plot ID: _____ B / C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20Other: ___-yr___; ____-mo___



Overstory: _____m^2 in Q ____ Pole: _____m^2 in Q _____ Seedling: _____m^2 in Q ____

Sampling Areas: Shrub: _____m^2 along Q4–Q1 • Q3–Q2 • 0P–50P • Q4–30 m

Shade in the sampling areas for each tree class and for the shrub sampling area(s) on the plot layout above.

Photo Subject Order		**Fuel Load Transects**		
			Azimuth	Slope
1. 0P → Origin	6. Q2 → Q3			
2. Q4 → Q1	7. P2 → Origin	1		
3. P1 → Origin	8. Q3 → Q2	2		
4. Q1 → Q4	9. Origin → REF	3		
5. 50P → Origin	10. REF → Origin	4		

Record photo documentation data for each visit on FMH-23, Photographic record sheet

Draw in fuel load transect lines on the plot layout above.

Date Entered: ____/____/____

Park/Unit 4-Character Alpha Code: _____

FMH-11 **FULL PLOT TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

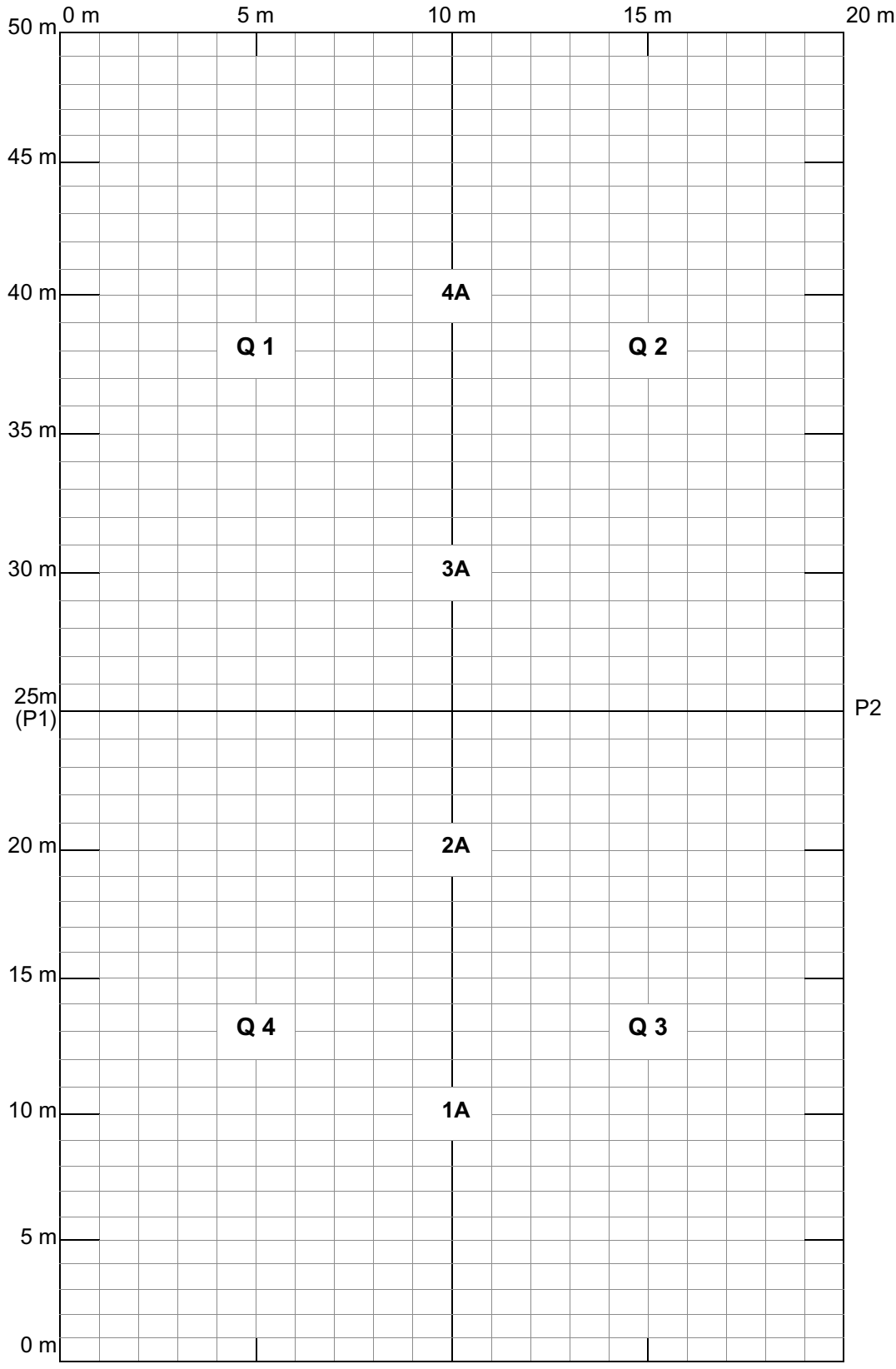
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-12 **QUARTER PLOT TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

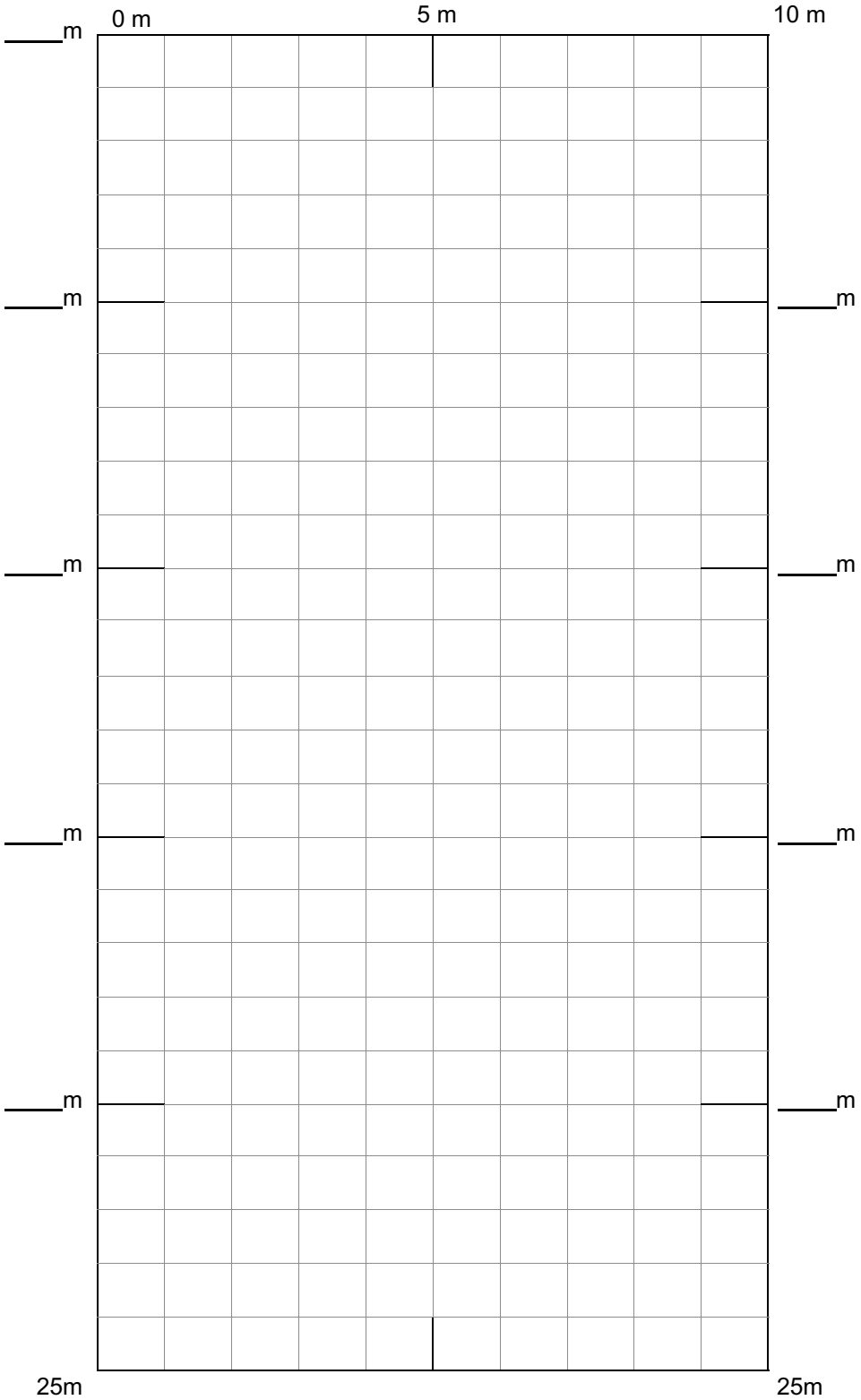
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-13 **ALTERNATE TREE MAP**

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

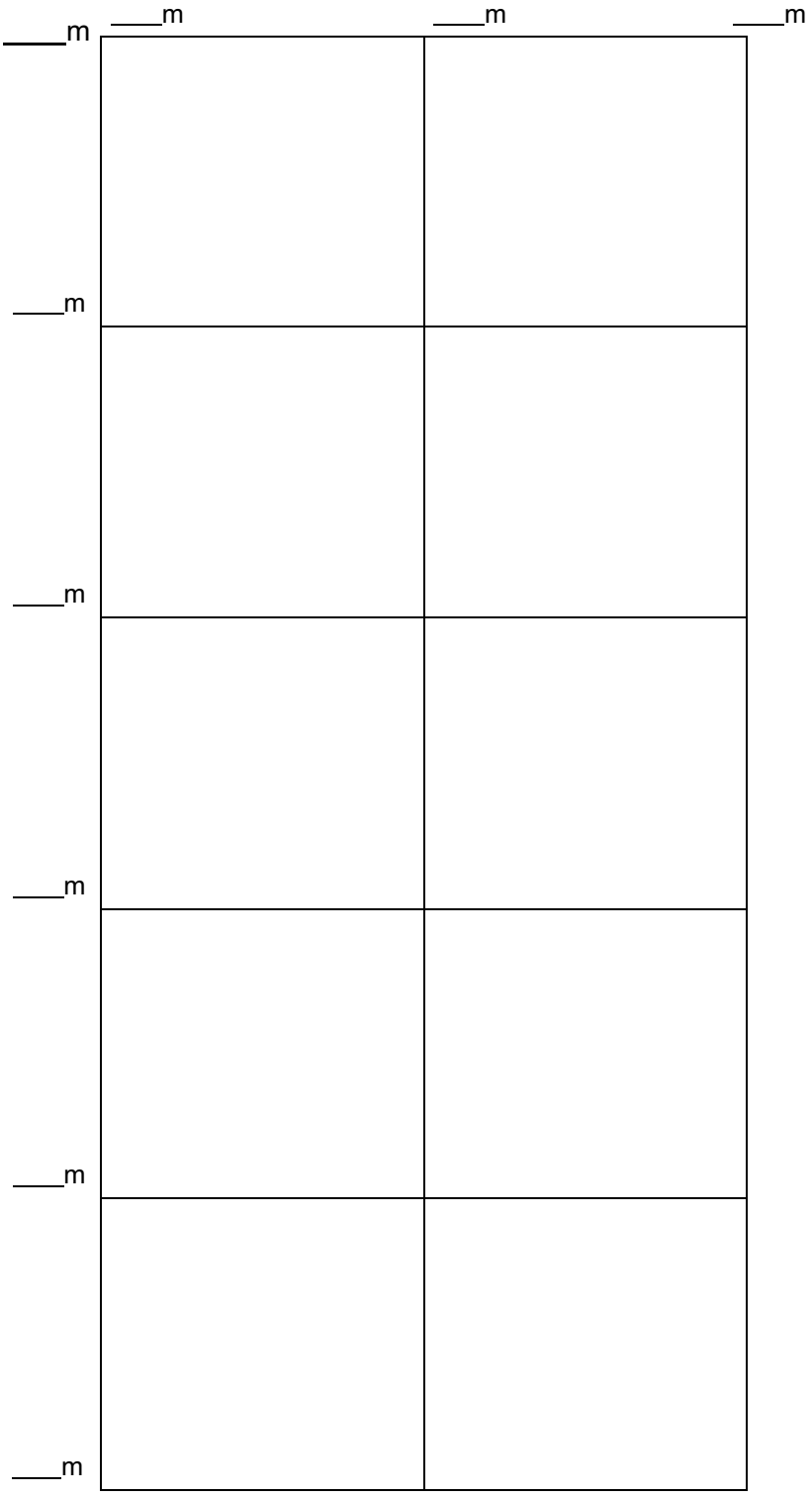
Tree Class

(Circle One)

Overstory

Pole

Seedling



Park/Unit 4-Character Alpha Code: _____

FMH-14

50 m^2 TREE MAP

Plot ID: _____ B/C (Circle One) Date: ____/____/____

Burn Unit: _____ Recorders: _____

Burn Status:Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01

00-PRE ____ Post ____-yr01 ___-yr02 ___-yr05 ___-yr10 ___-yr20 Other: ___-yr____; ____-mo___

Tree Class

(Circle One)

Overstory

Pole

Seedling